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CNU-XXX, (PROPOSED CONTAINER FOR CBU-75/B) ROUGH HANDLING, VIBR--ETC(U)
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B.S.

RICHARD T. GIBBONS

Mechanical Engineer

AUTOVON 787-3120

Commercial (513) 257-3120

CNU-XXX (PROPOSED CONTAINER FOR CBU-75/B) ROUGH HANDLING, VIBRATION, AND MECHANICAL HANDLING TEST

AFALD/PTPD
AIR FORCE PACKAGING EVALUATION AGENCY
WRIGHT-PATTERSON AFB OH 45433

January 1977

ABSTRACT

Developments in the area of munitions transportation and storage have eliminated the need for sealed metal containers for some weapons systems. This was the case when ADTC/SDM, Eglin AFB FL proposed an open metal crate to replace the CNU-218 container for the CBU-75/B dispenser bomb. The first prototype, developed by Lanson Industries, failed the vibration tests (AFALD Report #76-39). Based upon further evaluation and due to the excellent structural strength of the container a second prototype was developed. This second prototype then passed all phases of testing.

PREPARED BY: Richard T. Gibbons

RICHARD T. GIBBONS
Mechanical Engineer
Design Division

PUBLICATION DATE:

January 1977

REVIEWED BY:

RALPH ZYNDA
Chief, Design Division
Air Force Packaging
Evaluation Agency

APPROVED BY: Jack E. Thompson

JACK E. THOMPSON
Director, Air Force
Packaging Evaluation Agency

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INTRODUCTION

The office of prime responsibility (OPR) for the majority of testing to be conducted on the prototype containers for the CBU-75 weapon, was established at the Air Force Packaging Evaluation Agency (AFPEA). This was arranged by ADTC/SDM, Eglin AFB FL.

The first prototype (shown in Figure 2, page 11) was tested at the AFPEA on 13-14 October 1976 (see AFPEA Interim Report #76-39). At this time a critical design review was held and all problem areas were addressed. As a result of this design review and a subsequent review held at Lanson Industries, the second prototype design was developed and approved by personnel from ADTC/SDMT, ADTC/SD15, AFALD/PTP, OO-ALC/DSTM, and HQ AFLC/MMW.

Major design changes between the first and the second prototype are:

1. H-frame tie-down configuration was simplified and made more reliable (see Figure 3, page 11 and Figure 4, page 12).

2. Packaging and removal of the CBU-75/B was made easier by having mechanically expanding container ends.

3. Container was redesigned to accept the two weapons with their aft ends oriented in the same direction.

4. Saddle cushioning was secured with rivots and adhesive on the second prototype. The first prototype used only adhesive as a bonding agent.

Testing of the second prototype (see Figure 5, page 12) was accomplished on 1-3 December 1976 at the AFPEA. The test plan followed is shown in Figure 1, page 9. This is the same basic test plan that was followed for testing prototype I which was terminated part way through the test sequence due to container failure. The prototype II container, however, passed all tests shown on the test plan.

TEST OUTLINE

Following are tests performed on the prototypes indicated and in accordance with FTMS 101B using the specified methods as listed. The actual test sequence is listed below:

TEST #	TEST	FTMS METHOD	PROTOTYPE	ORIENTATION
A-1	Vibration	5019	I	Base, Normal
B1-1	Edgewise Drop	5008	I	Opposite Ends
B2-1	Cornerwise Drop	5005	I	Diagonal Opposite Ends
B3-1	Pendulum Impact	5012	I	Opposite Ends
A-2	Vibration	5019	II	Base, Normal
B1-2	Edgewise Drop	5008	II	Opposite Ends
B2-2	Cornerwise Drop	5005	II	Diagonal Opposite Ends
B3-2	Pendulum Impact	5012	II	All Sides
C-1	Mech Handling	5011	II	As Required
A-3	Vibration	5019	II*	Base, Normal
B1-3	Edgewise Drop	5008	II*	Opposite Ends
B2-3	Cornerwise Drop	5005	II*	Diagonal Opposite Ends
B3-3	Pendulum Impact	5012	II*	All Sides
C-2	Mech Handling	5011	II*	As Required

* Test conducted with only one CBU-75B in container.

TEST PROCEDURE AND RESULTS

1. Vibration (Test #A-1). (See Figure 6, page 13.) The equipment used to conduct vibration testing was a L.A.B. Vibration Machine, Serial 56801, Type 5000-96B. The basic vibration platform was fitted with a table adapter constructed of plywood measuring 96" long by 96" wide by 1.5" thick bolted to the original vibration platform. The container was vibrated on this platform at 4.5 Hz for 22 minutes. The 4.5 Hz was selected as the vibration frequency because at his point, the container was receiving a 1G shock from the 1" double amplitude displacement.

Due to excessive friction between the CBU-75s and the container saddles, metal-to-metal contact was discovered and testing was terminated after 22 minutes elapsed time. The damage (see Figure 7, page 13) was due to the protective rubber strip saddle covers separating from the saddle (see Figures 8 and 9, page 14). At this point, the container failed to pass the specified testing, however, in order to determine any other potential deficient areas, testing was continued at the request of the personnel from Eglin AFB. In order to procede with the next phase of testing, the problem was temporarily corrected (see Figures 10 and 11, page 15.

2. Edgewise Drop (Test #B1-1). The container was placed on its bottom with one end of the base of the container supported on a sill nominally six inches high. This height assured that there was no support on the base between the end of the container during dropping. The unsupported end of the container was then raised to a height of 12 inches and released for impact.

This test was applied to each end of the container. The test resulted in slight bending of the lateral members. There was no additional damage to the two CBU-75 dispensers and neither rotated in the saddles.

3. Cornerwise Drop (Test #B2-1). One corner of the base was supported on a block nominally six inches high and a block nominally 12 inches high was placed under the other corner of the same end. These blocks provided a condition where there was no support for the base between the ends of the container during the drop. The unsupported end of the base was raised so that the lower corner of the base was raised 12 inches. The container was then released and allowed to impact the concrete floor. This test was applied to two diagonally opposite corners of the base of the container.

Slight bending of the lateral container members occurred. The CBU-75s remained undamaged and there was no lateral shifting of the dispensers.

4. Pendulum Impact (Test #B3-1). The container was placed on a platform with the impact end extending over the edge of the platform to insure contact with the concrete bumper. The platform was then pulled back so that the center of gravity of the container was raised nine inches. Upon release, the platform then swung to impact the concrete bumper with an impact velocity of 7 fps. This procedure was followed for testing both ends of the container.

This test was conducted to observe the ability of the lug restraint unit to securely hold the dispensers in place. Neither impact produced any appreciable dispenser movement. There was no damage noted to the dispensers and only slight damage to the container (see Figure 12, page 16).

Upon completion of the pendulum impact test, both dispensers were removed from the container. There was no problem encountered while removing either dispenser and, therefore, container damage received during the rough handling portion of testing did not affect the functionability of the container.

At this point, testing of the prototype I container was terminated and plans were developed for testing of the prototype II container. This container (see Figure 13, page 16) arrived on 30 November 1976 and was tested on 1-3 December 1976. The results are shown in the following paragraphs.

5. Vibration (Test #A-2). The procedure for this vibration test was identical to that described in test A-1 above except that the test ran for the prescribed two hours. At the conclusion of the test, there was no visible damage to either the container or to its contents. There was no movement of the dispensers inside the container and all hold-down equipment remained tight and functional.

6. Edgewise Drop (Test #B1-2). The procedure for this test follows exactly the procedure outlined in test #B1-1 above. Damage resulting from this test consisted of distortion of the diagonal supports located at the impact end. The most severe distortion was a bend (see Figure 14, page 17) which displaced one diagonal approximately 0.750 inch and the diagonally opposite corner diagonal 0.250 inch.

7. Cornerwise Drop (Test #B2-2). The procedure for this test follows exactly the procedure outlined in test #B2-1 above. Results of this test indicate that in all places where there was previous deformation of a structural member, that deformation increased (see Figure 15, page 17).

8. Pendulum Impact (Test #B3-2). The procedure followed in the initial pendulum impact test (test #B3-1 above) was identical to the procedure followed in this test except that during this test all four sides were impacted. After the impact of all four sides, the only damage observed was a slight bend in the top rails of the container. There was no damage to either dispenser.

The lug hold-down restraint device continued to provide enough tension at the end of testing so that no play in the dispensers could be noted in any direction. The forward and aft end restraints were all tight and functional. Dispenser removal was then attempted and no problems were encountered during this test of functional operation.

9. Mechanical Handling (Test #C-1). A hard rubber tired forklift truck was used on the AFPEA road test course for this phase of testing. The road course was set up to fully comply with FTMS 101B Method 5011, para 6.2 and the procedure container therein was strictly adhered to. The prototype II container was lifted clear of the ground and tested on the road course to determine container stability. The container exhibited no signs of being an unstable load. The large mass and relatively small size made maneuvering the container by means of forklift truck very easy and it also appeared quite stable when lifted to simulate a stacking operation.

The procedure for conducting the pushing test was to position the container on level clean dry pavement and to abut it with a forklift truck at one end and push the container at a rate of 35 feet in 85 seconds. After this was complete, the container was rotated 90 degrees and with the forklift truck abutted to the container side, again pushed 35 feet in 85 seconds. This conforms with para 6.5 of FTMS 101B Method 5011.

The underside of the container was inspected for damage and excessive wear and none was found. The container also seemed quite stable while being pushed, probably due to the large mass.

The towing procedure consisted of attaching slings to the two end lifting rings and towing the container by forklift truck over 100 feet of level dry pavement. The slings were then attached to the two side lifting rings so the container could be towed again over 100 feet of pavement. This is outlined in FTMS 101B Method 5011 para 6.6.

No problems were encountered in any of the mechanical handling tests performed. The design of this container is such that normal mechanical handling will have no adverse affect on either the container or on the CBU-75/B dispensers.

At this point, both dispensers were removed and thoroughly examined. No damage was found. Only one dispenser was then reinserted in the prototype II container (see Figure 16, page 18). This was done to simulate partial shipments, which are a definite possibility within the distribution system. The following tests were conducted on the container in this configuration.

10. Vibration (Test #A-3). The initial set-up and procedure are identical to those described in test #A-2 above except that the vibration time was reduced to 0.5 hours. The purpose of this test was to observe the stability of the pack during vibration, and not how well the container endured the test.

Upon conclusion of this test, the dispenser had not rotated and all lug restraints performed well. There was no damage to the dispenser or container, however, all four container lifting lugs vibrated loose and fell off.

11. Edgewise Drop (Test #B1-3). Again the drop test procedure described in test #B1-1 above was followed. There were no signs of instability in the container and all restraint devices functioned normally. There was no additional damage to either the container or the CBU-75/B dispensers.

12. Cornerwise Drop (Test #B2-3). The procedure followed in this test was identical to that in test #B2-1 above. The results from the test clearly indicate that this container is stable when subjected to the drop test sequence. There was no additional damage observed on either the container or the dispensers.

13. Pendulum Impact (Test #B3-3). This test was conducted using procedures established in test #B3-1 above. There were no adverse results from this test sequence and it can be inferred that the change in total weight, as well as the change in container center of gravity, had little or no affect on the stability.

14. Mechanical Handling (Test #C-2). The procedures for conducting these tests are discussed in test #C-1 above. The stability of the container, when tested as outlined in para 6.2, 6.5, and 6.6 in FTMS 101B Method 5011, was not affected by the unsymmetrical loading. The container performed well during all testing.

DISCUSSION

Testing of the first container (prototype I) was very instrumental in developing the second container (prototype II) to a point where it would pass all vibration and rough handling tests. The procedure of continuing to test, after initial failure during the vibration test, was productive as far as trouble shooting possible problem areas.

One area that needs further attention is the lifting rings (see Figure 17, page 18). Vibration for a total of 2.5 hours had loosened the rings to a point where they fell off. Had this happened in shipment, the rings may have been lost and could have possibly caused some handling problems. Lanson Company representatives are aware of this problem and it should be resolved during production of the next prototype.

Plans are currently underway to conduct two-high stacked vibration tests. The results of this test will serve as parameters as to the strengths/weaknesses of the stacking hardware and vertical structural members of the container.

The prototype #II container (as shown in Figure 18, page 19) passed all phases of tests conducted at the AFPEA. Any bending or distortion of the container that occurred during testing did not affect the ease of removal of CBU-75/B dispensers. The lug restraints, as well as forward and end restraints, functioned properly at all times.

The results of all testing performed at the AFPEA indicate that containers for the CBU-75/B dispensers, built to specifications of prototype #II container tested should provide adequate protection in the Air Force shipping and handling environment.

AIR FORCE PACKAGING EVALUATION AGENCY
(Container Test Plan)

AFPEA PROJECT NUMBER	76-P7-61
CONTAINER SIZE	90 x 45 x 29
WT (GROSS)	4660
WT (ITEM)	2 x 2000
CUBE	67.97
QUANTITY	2
DATE	20 Sep 76
ITEM NAME	CBU-75/B
MANUFACTURER	Lanson Industries
CONTAINER NAME	CNU-285/E (Replaces CNU-218/E)
CONTAINER COST	N/A
PACK DESCRIPTION	Open Crate
CONDITIONING	None

TEST NO.	IAW	PARAMETERS	ORIENTATION	INSTRUMENTED
5019	FTMS 101B	1" double amp 4.5 Hz	Base, normal	Yes
5005	FTMS 101B	12" drop height	Diagonal opposite corners	Yes
5008	FTMS 101B	12" drop height	Opposite ends	Yes
5012	FTMS 101B	7 fps	Opposite ends	Yes
5011	FTMS 101B	Para 6.5, 6.6		No
5011	FTMS 101B	Para 6.3.2.2		No

COMMENTS

PREPARED BY	RICHARD T. GIBBONS/Design Division
APPROVED BY	RALPH ZYNDA/Chief, Design Division

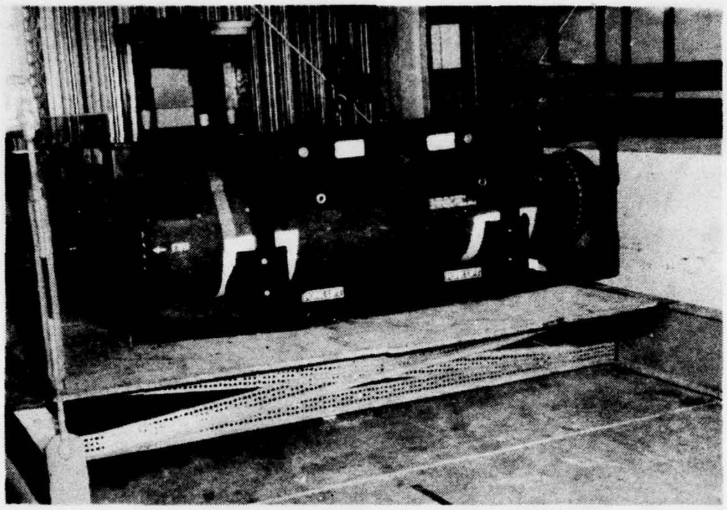

FIGURE 2. PROTOTYPE I

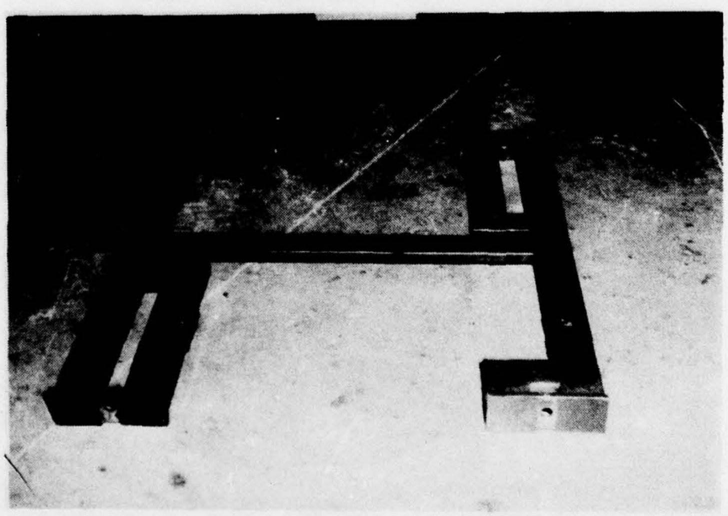

FIGURE 3. H-FRAME TIE-DOWN

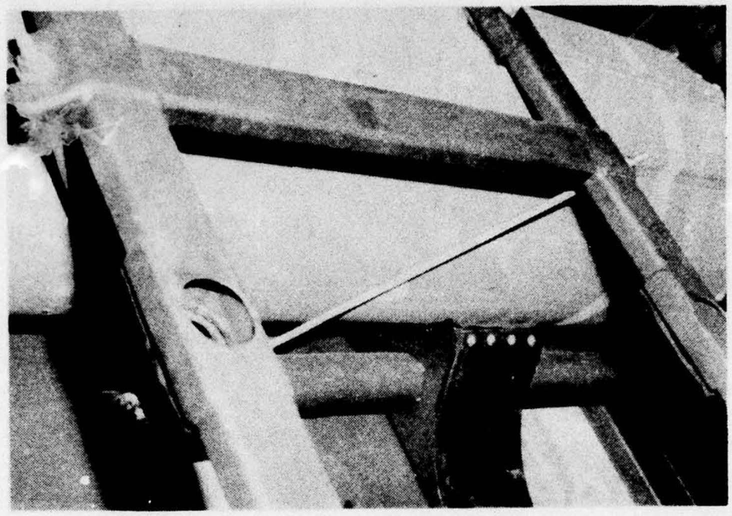

FIGURE 4. H-FRAME ATTACHED

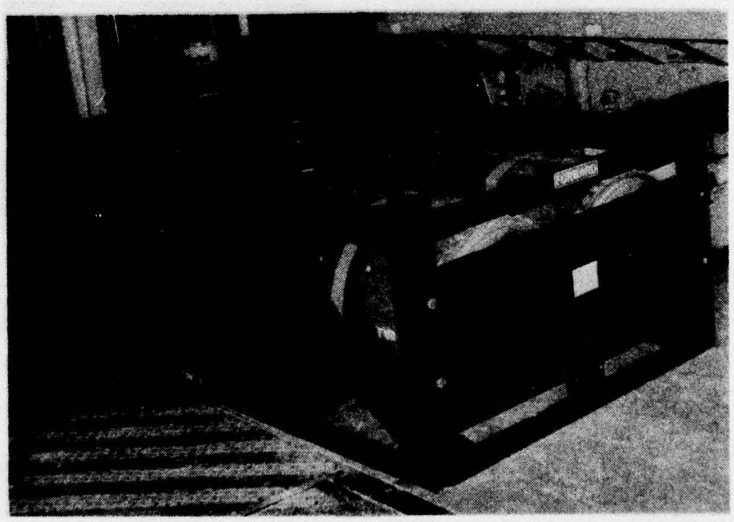

FIGURE 5. PROTOTYPE II

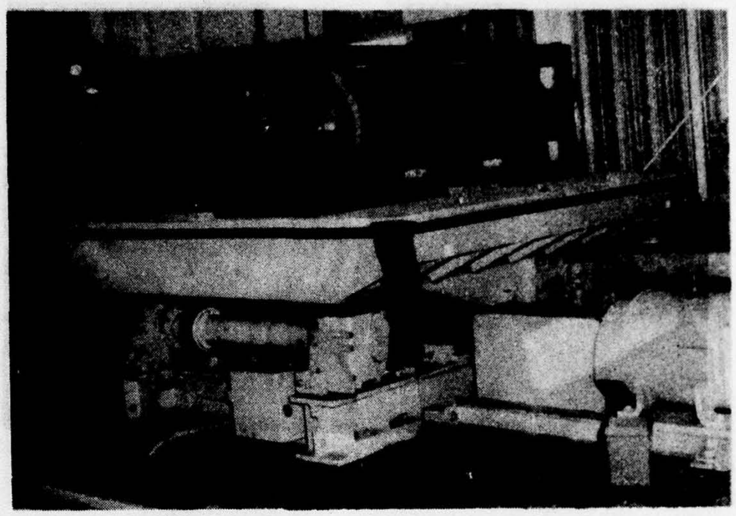

FIGURE 6. VIBRATION TEST

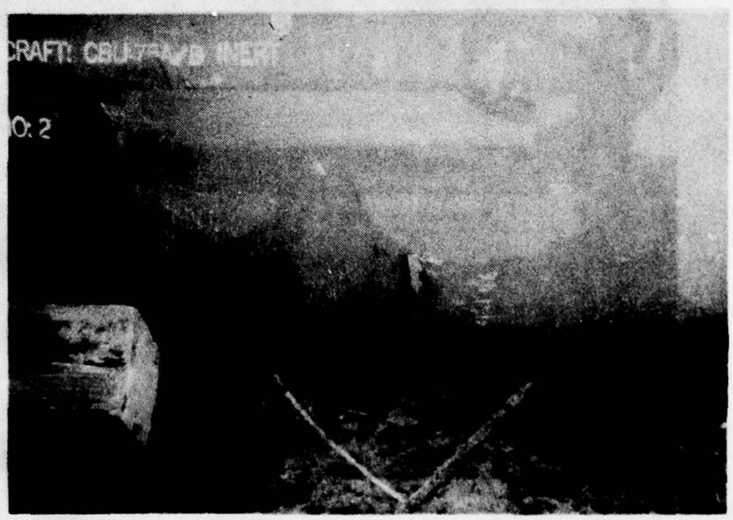

FIGURE 7. DAMAGE FROM VIBRATION TEST

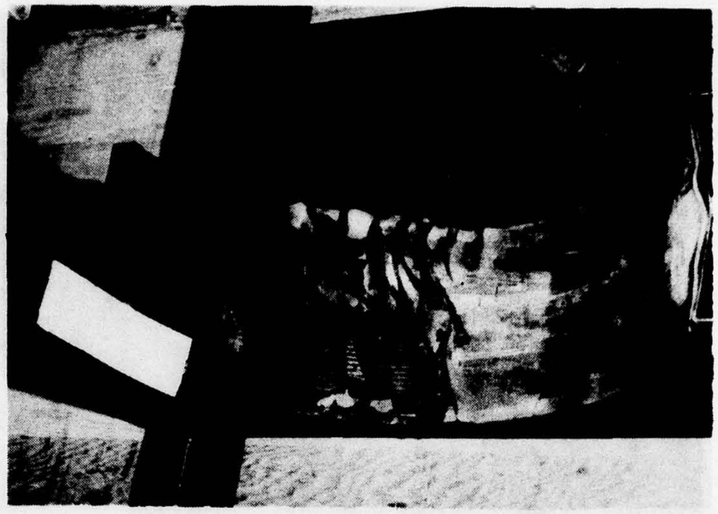

FIGURE 8. SADDLE DAMAGE (FWD)

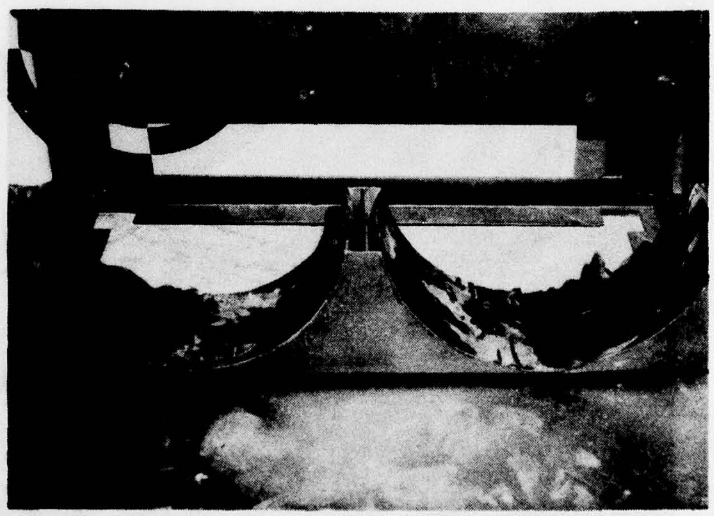

FIGURE 9. SADDLE DAMAGE (AFT)

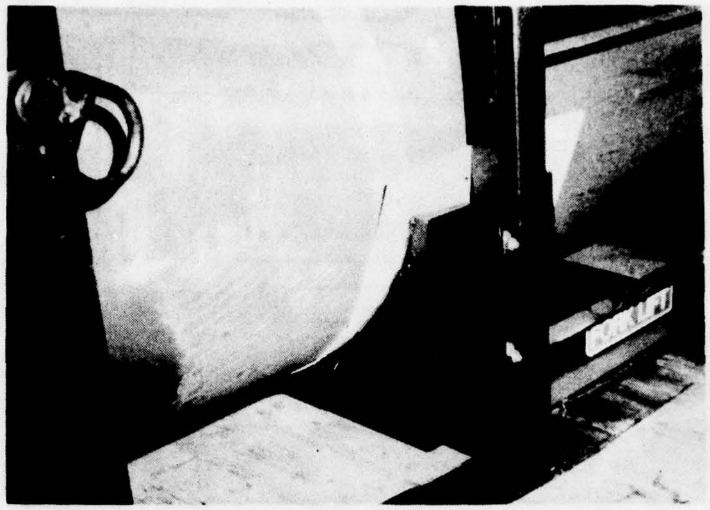

FIGURE 10. TEMPORARY FIX (SIDE VIEW)

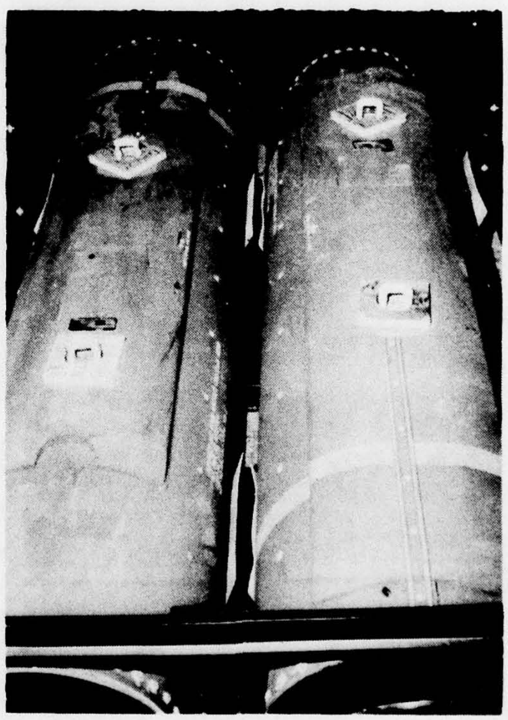

FIGURE 11. TEMPORARY FIX (TOP VIEW)

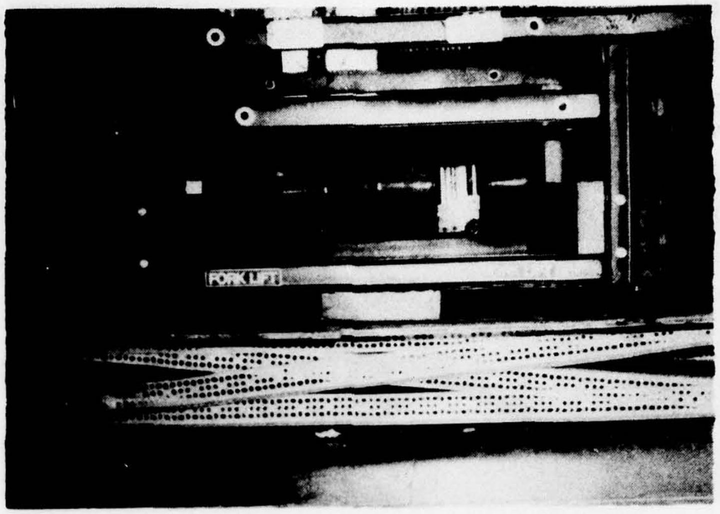

FIGURE 12. SIDE DAMAGE (PENDULUM)

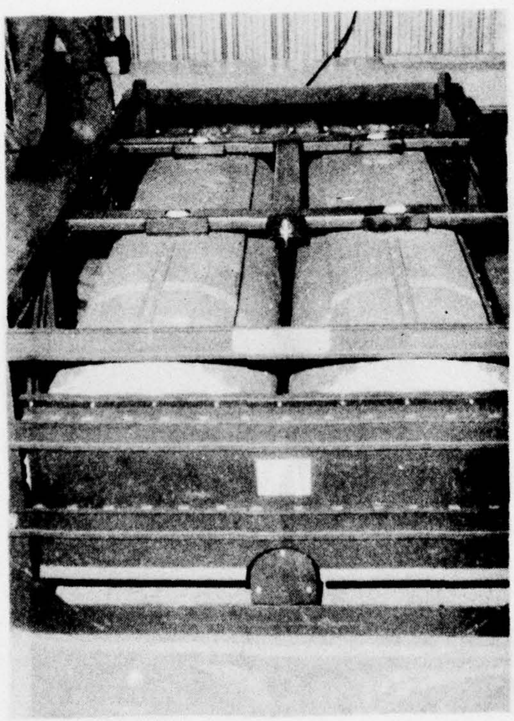

FIGURE 13. TOP VIEW OF PROTOTYPE II

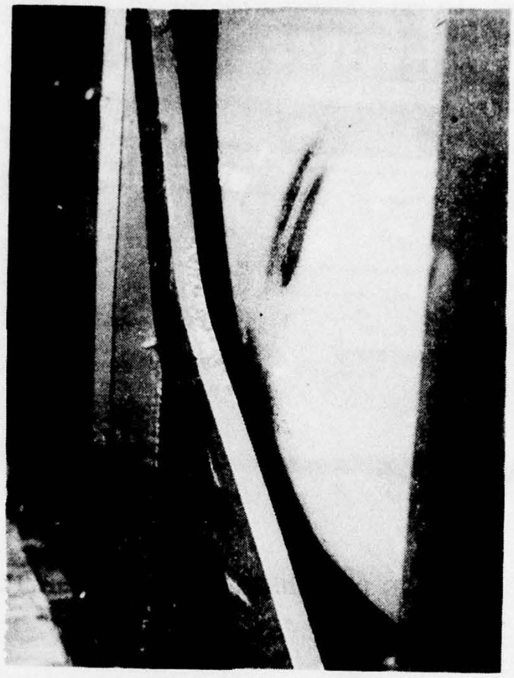

FIGURE 14. DIAGONAL SUPPORT DAMAGE

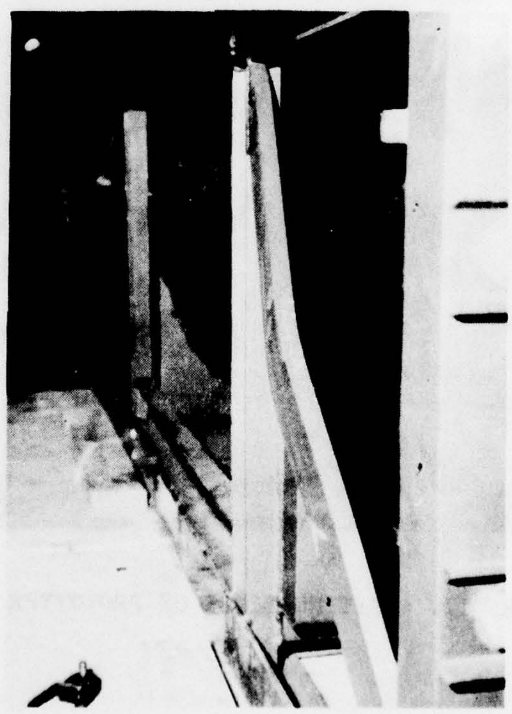

FIGURE 15. INCREASE IN DAMAGE

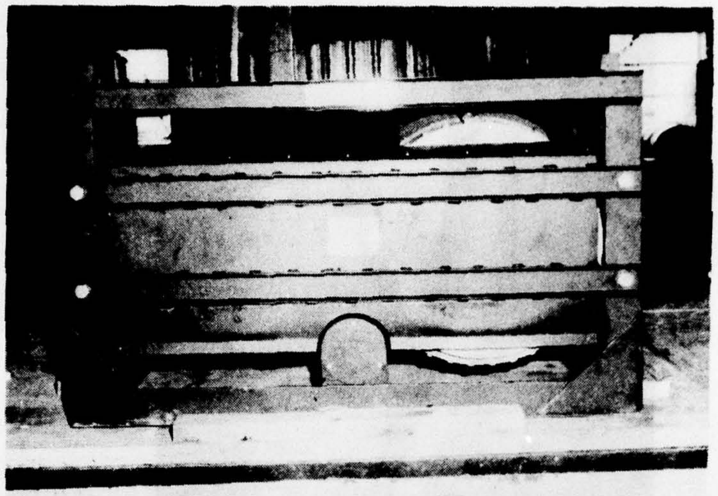

FIGURE 16. ONE DISPENSER IN PROTOTYPE II

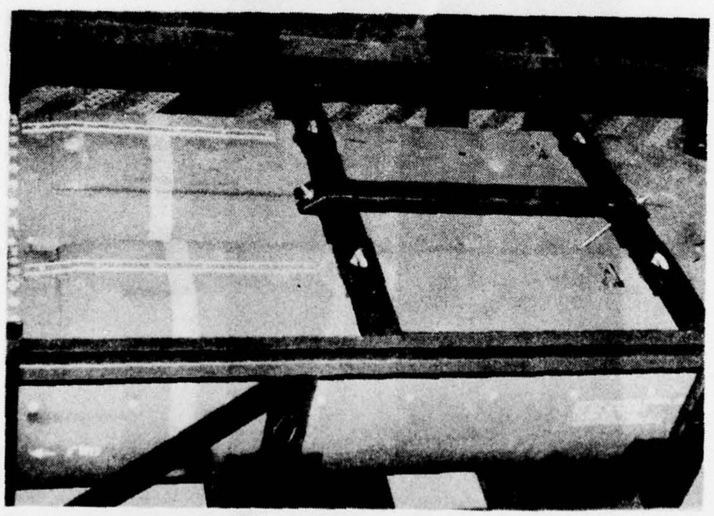

FIGURE 17. LIFTING RINGS ON PROTOTYPE II

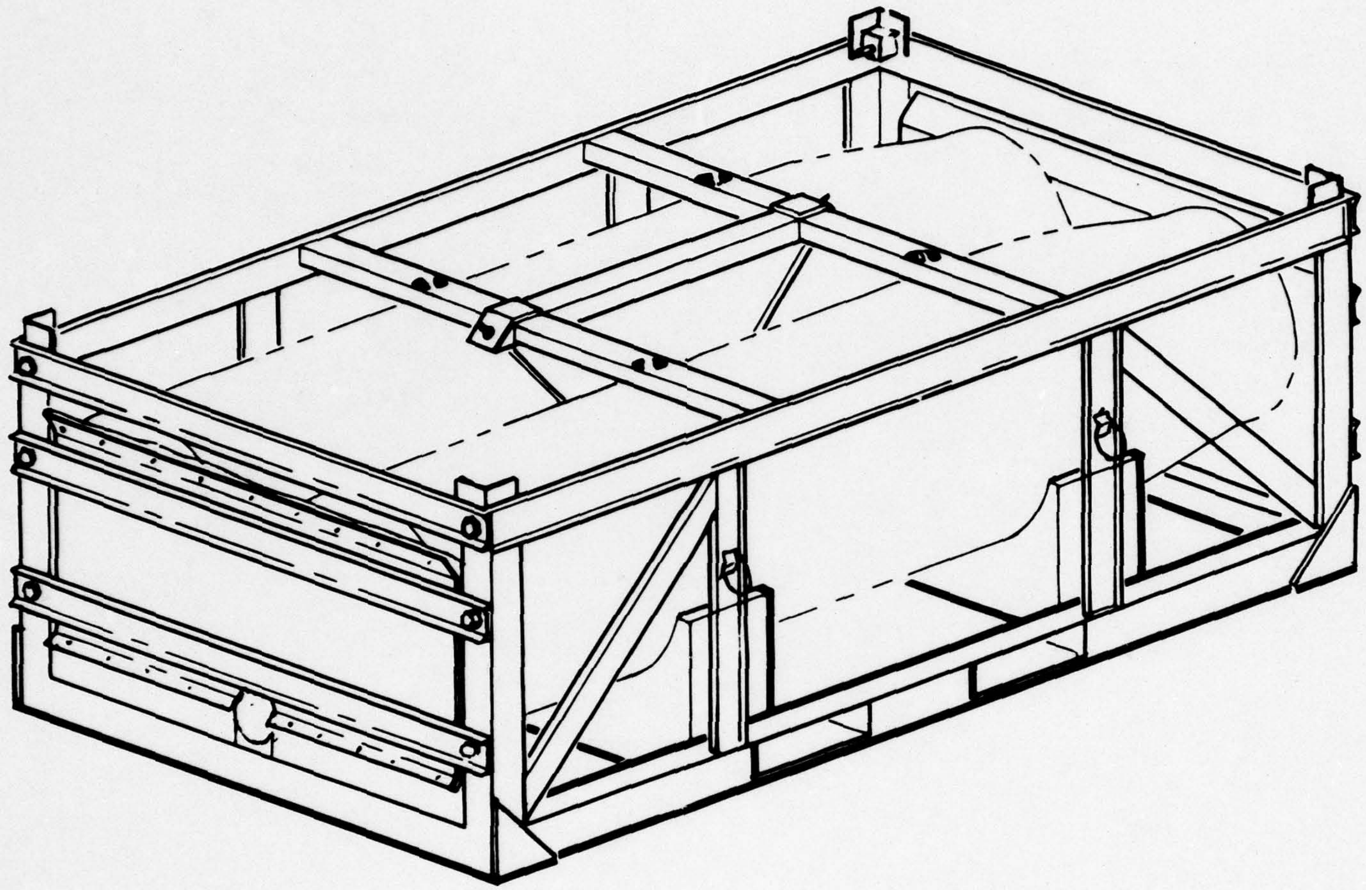

FIGURE 18. THE PROTOTYPE II CONTAINER

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Container	CNU	Vibration Tests
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Dispenser	Rough Handling Tests	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Developments in the area of munitions transportation and storage have eliminated the need for sealed metal containers for some weapons systems. This was the case when ADTC/SDM, Eglin AFB FL proposed an open metal crate to replace the CNU-218 container for the CBU-75/B dispenser bomb. The first prototype, developed by Lanson Industries, failed the vibration tests (AFALD Report 76-39). Based upon further evaluation and due to the excellent structural strength of the container a second prototype was developed. This second prototype then passed all phases of testing.

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